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(58) Field of search
A2Q

(71) Applicant
Kabushiki Kaisha Airin (Japan),
No. 5 1 Banchi, Aza-Okiorito, Myodaiji-Cho, Okazaki-shi,
Aichi Prefecture, Japan

(72) Inventor
Yoshikazu Hayashi

(74) Agent and/or address for service
Marks & Clerk, 57—60 Lincoln's Inn Fields, London
WC2A 3LS

(54) Production of cakes of granular material

(57) A cake or cracker is formed from granular material such as unhulled rice. The granular material is fed by feeding plate 52 into the gap between heated upper and lower baking moulds 43 and 34 which are then lowered to form a hermetically closed damper and so that the material is compressed and heated for a predetermined time. The upper mould 43 is briefly moved up a small distance and then down, to spread the material on the lower mould 34, and the material is compressed and heated again. The compressed and heated material is expanded when the upper mould 43 starts moving upwardly to remove the compression, thereby shaping the material in a cake of a desired form in a self-sustaining structure which is then moved from mould 34 onto chute 62 by movement of plate 52. The up and down movement of the moulds 34, 43 and the lat ral m vement f a fe ding plat 52 is c ntr lled by rotary cams 20, 22, 24 respectively via r llers 40, 49 and 59.

FIG. 2

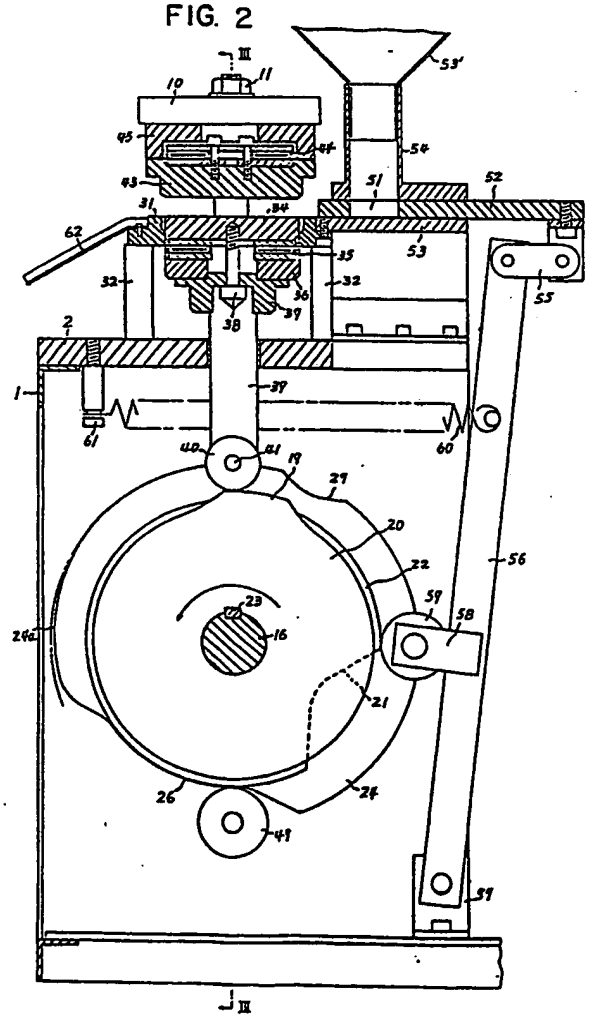

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FIG. 1

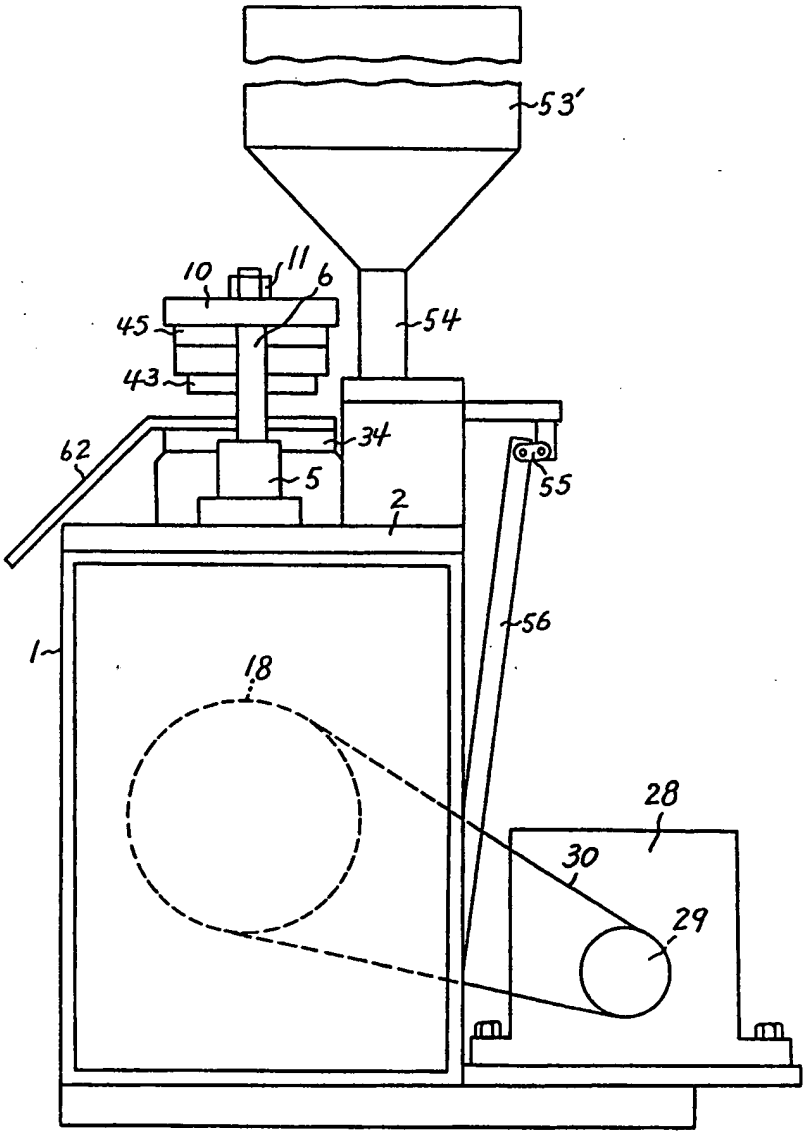

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FIG. 2

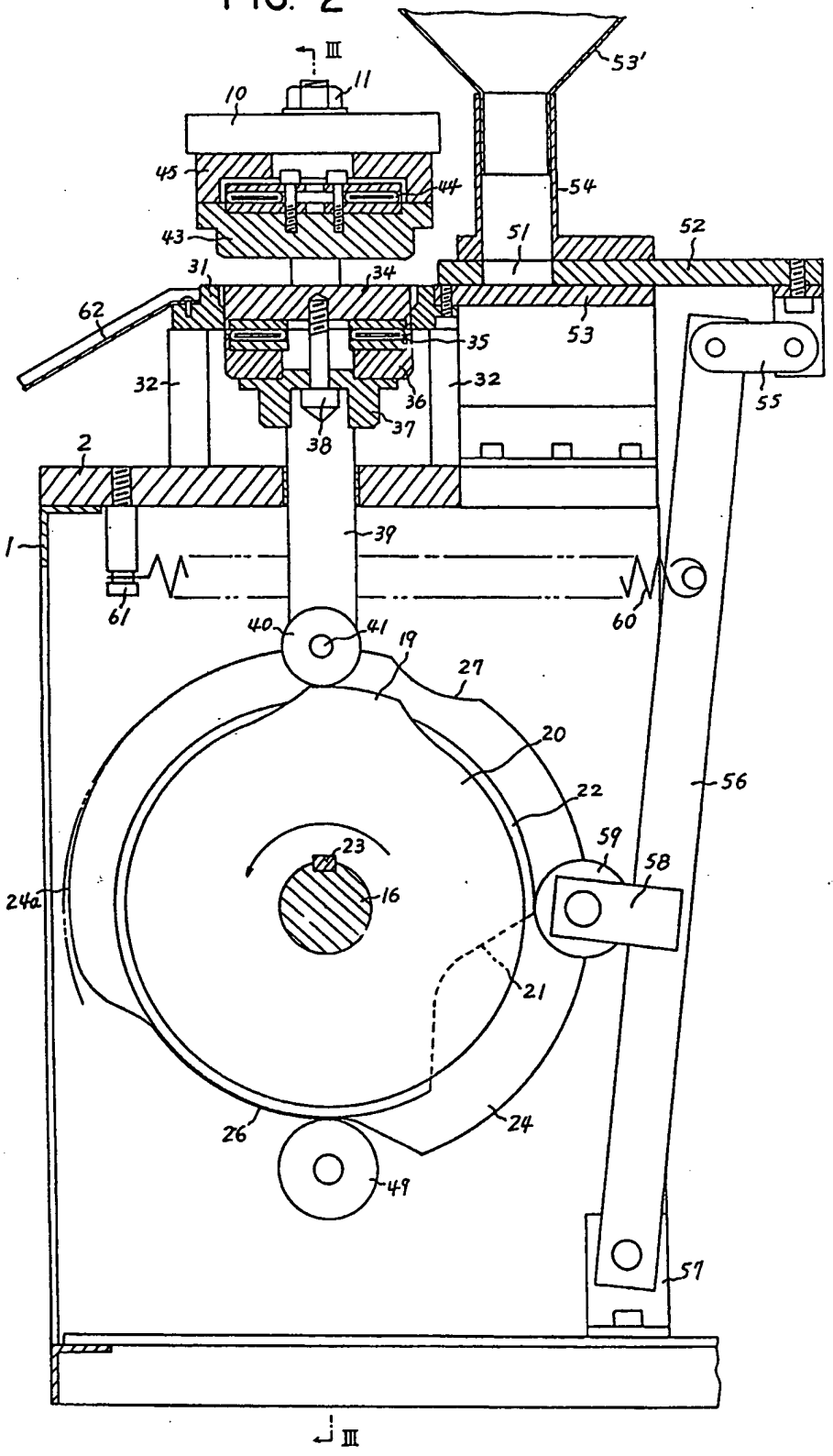

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FIG. 3

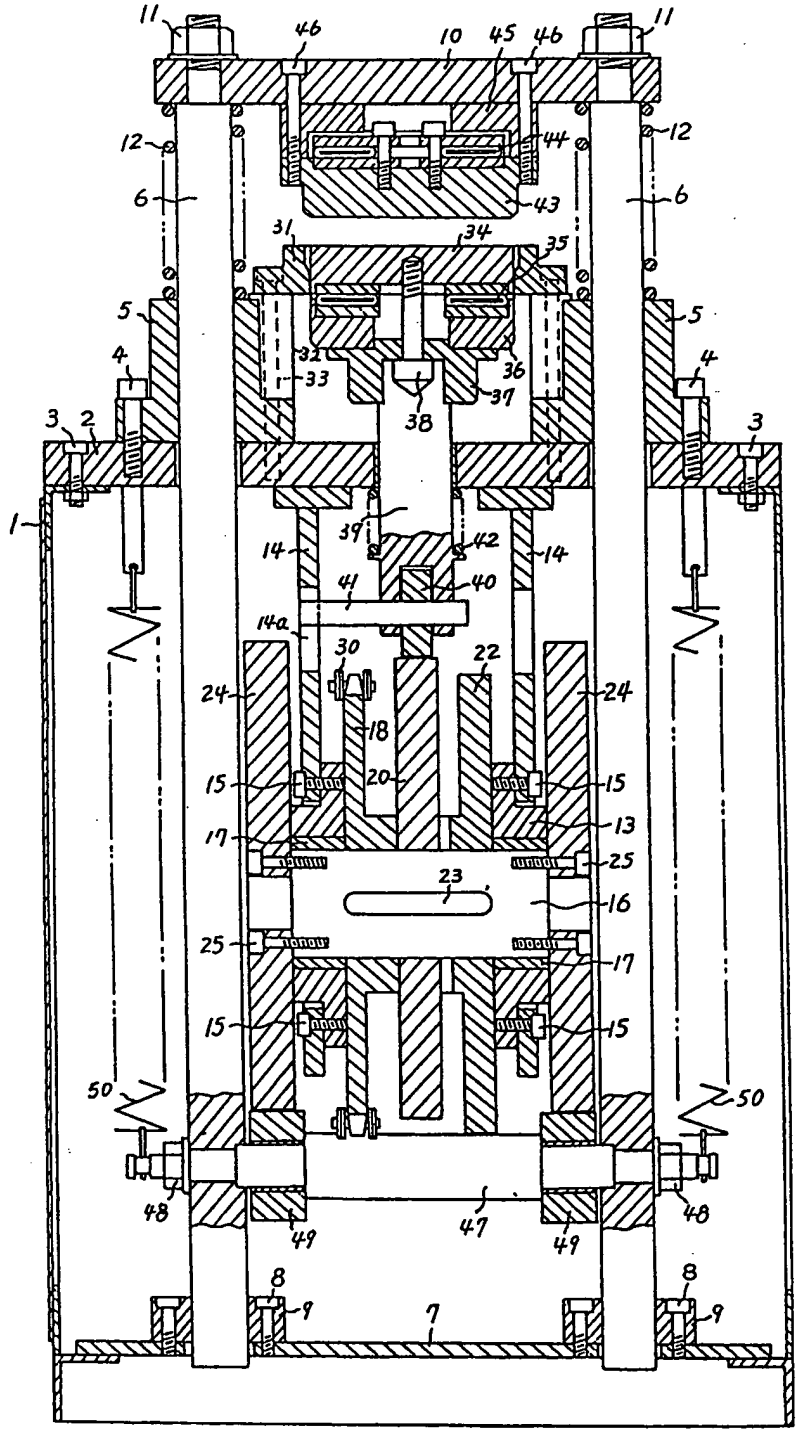


FIG. 4

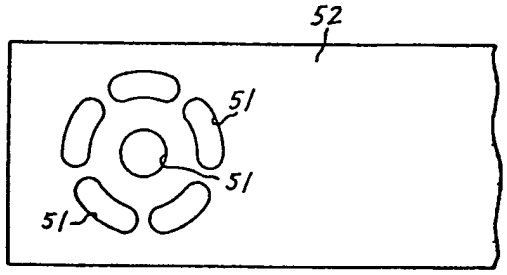


FIG. 5

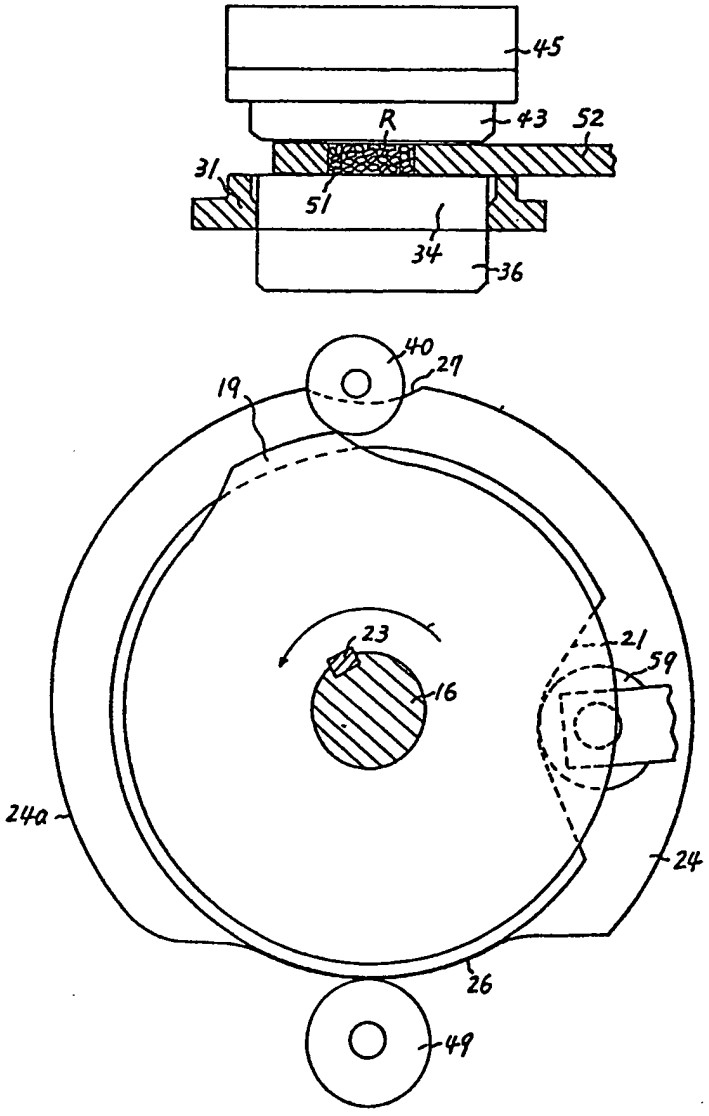
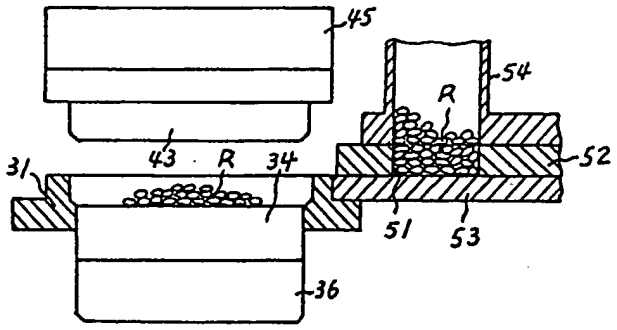


FIG. 6



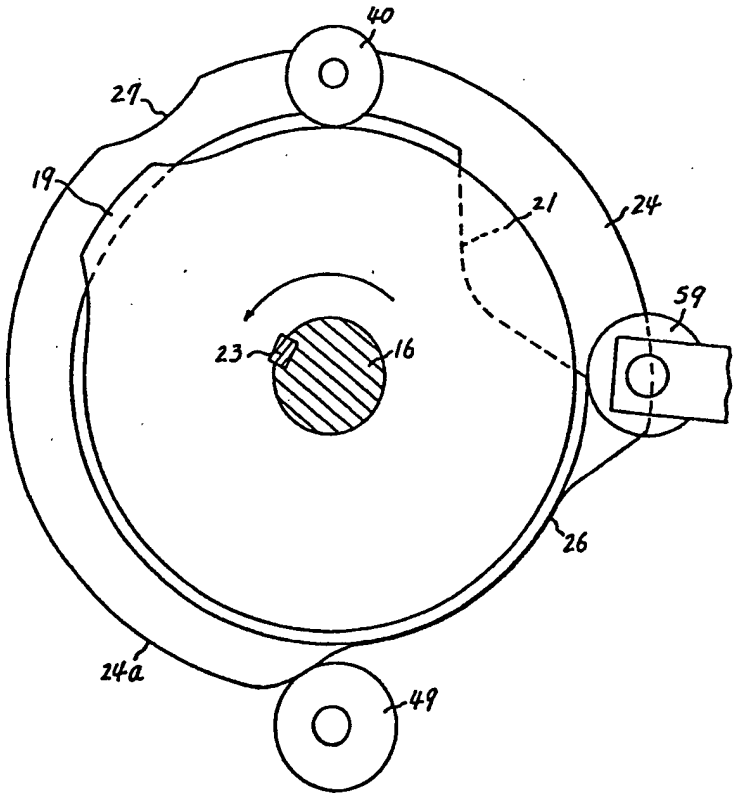
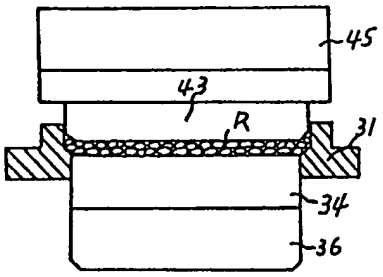


FIG. 7



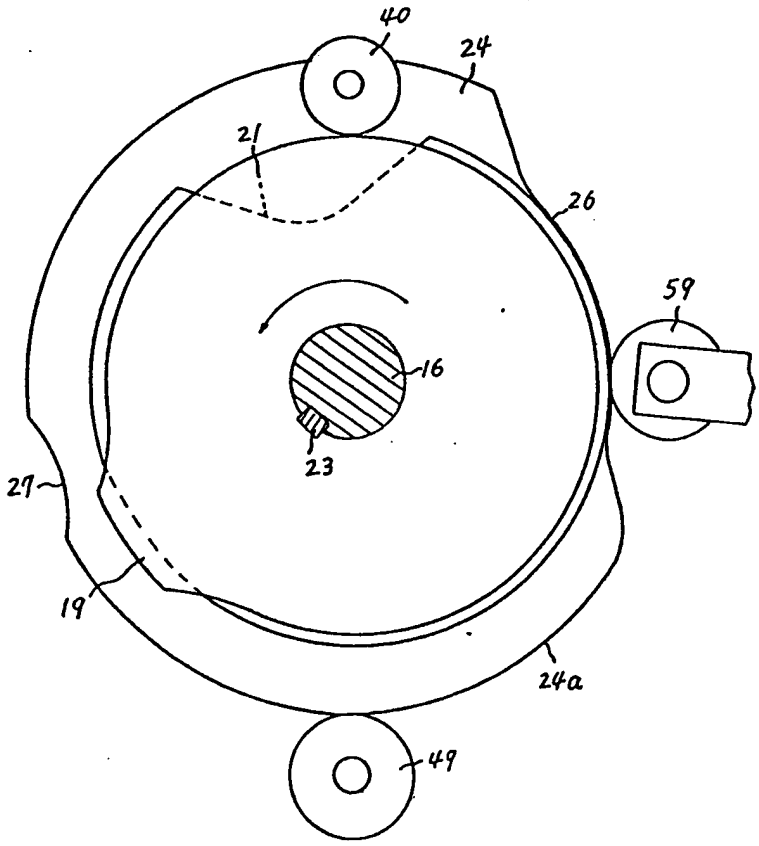


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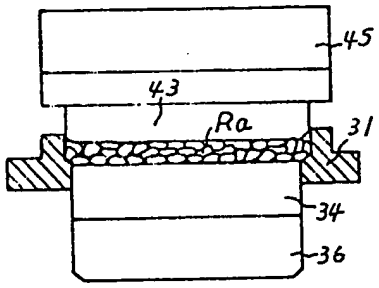
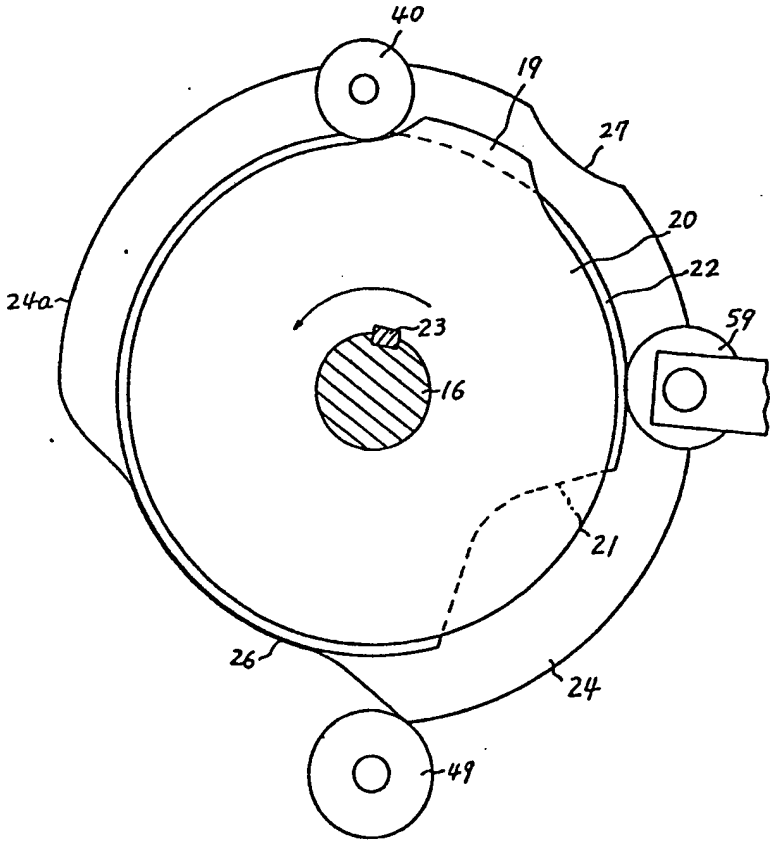
FIG. 8





SPECIFICATION

Production of cakes of granular material

The present invention relates to a method of producing a cake or cracker from granular material, such as grain, e.g. unhulled rice or the like, or artificial rice, starch or the like mixed with desired raw materials such as cheese, tiny fish, shrimp, vegetable, or the like and formed into chips. This invention also relates to apparatus for carrrying out the method.

Heretofore, cakes sometimes known as crackers, produced from such raw materials as rice, soybean, corn, or the like, have been liked by many people as nourishing natural food. In the known method for producing this type of foods, a raw material already processed in advance to have a predetermined water content is fed into heated and air-tight chamber defined in upper and lower baking moulds, compressed and heated therein. Thereafter, upon lapse of a predetermined time, the upper or the lower mould is vertically moved to remove the compression. As a result, the raw material is caused to expand instantaneously to form a cake or a self-sustaining structure.

In the known method set forth above, vertical movement of the upper and lower baking moulds, or sliding movement of a slide plate for feeding the raw material into the lower mould is performed by actuation of an air cylinder. However, employment of the air cylinder has the disadvantage that even a slight change of air quantity fed from a compressor delicately changes the movement of, inter alia, the upper and the lower moulds, resulting in too large or too small compression on the raw material. As a result, baking conditions for the raw material are changed. In addition, due to change of removing speed of the compression, etc., the thickness of the expanded cakes cannot be made uniformly, which badly spoils a production value thereof. Furthermore, actuation of the air cylinder requires installation of a compressor. Accordingly, an assembly of such apparatus as a whole is required to be made large. Moreover, its structure becomes complicated due to arrangement of electric circuits, installation of various kinds of valves, connection of air hoses, etc. The complicated structure often brings about mechanical troubles. A consideration is also made to employ a hydraulic cylinder instead of the air cylinder. However, the hydraulic cylinder assembly itself is bulky and expensive. Besides, the hydraulic cylinder possesses fundamental disadvantages, viz. it cannot reverse the direction of movement while it is in the process of advancing or retreating movement, nor can it advance or retreat instantaneously. Accordingly, the hydraulic cylinder is not desirable for practical use for a cake producing apparatus, in which delicate actuation and movement of component parts there of are required.

The present invention provides a method of producing a cake or cracker from a raw or pre-processed material such as grain such as unhulled rice, or artificial rice, composite raw material formed in a chip-shape, or the like, comprising steps of compressing and heating for a predetermined time the raw material optionally processed to some extent in advance and contained within a hermetically closed chamber defined between heated upper and lower baking moulds, moving instantaneously the upper mould finely up and down to spread the raw material on a bottom surface of the lower baking mould, and in the foregoing state, compressing and heating the material again, and expanding instantaneously the compressed and heated material at a time when the upper baking mould starts moving upwardly to remove the compression, thereby shaping the material in a cake or cracker of a desired form in a self-sustaining structure.

The invention also provides apparatus for producing a cake or cracker from a raw or pre-processed material such as grain such as unhulled rice, or artificial rice, composite raw material formed in a chip-shape, or the like, comprising a lower baking mould adapted to be heated by a heater and moved upwardly, an upper baking mould adapted to be moved upwardly and downwardly relative to the lower baking mould and received within the lower baking mould in an air-tight manner at a time when the former is moved downwardly, the upper baking mould being also adapted to be heated by the heater and a slidable dosimeter or feeding plate formed with a quantative hole or holes for transporting a predetermined quantity of the material contained in a hoper to the lower baking mould, the dosimeter or feeding plate being adapted to serve both for pushing outwardly a shaped and self-sustaining cake or cracker from the lower baking mould and for feeding the predetermined quantity of raw material into the lower mould through the quantative hole when the upper baking mould is at a lifted position, the upper and the lower baking moulds, and the feeding plate being actuated by means of rotation of respective cam plates each provided thereon.

The apparatus may function as follows. The rotation of respective cam plates coaxially mounted on a driving shaft causes the upper baking mould to move upwardly which in turn causes the dosimeter or feeding plate to move forwardly for feeding a predetermined quantity of the granular material onto the lower baking mould. Upon completion of the feeding of the material onto the lower mould, the dosimeter or feeding plate is moved backwardly. Thereafter, the upper mould is moved downwardly to be received in the lower baking mould in an air-tight manner, and the raw material within the baking mould is compressed and heated. At a time when the upper baking mould starts moving upwardly after a lapse of a predetermined time, the material is expanded and formed into a self-sustaining structure within a chamber defined between the upper and the lower baking moulds. In this way, the discharging of the cake (e.g. rice cracker) from the lower mould and the feeding of the material are carried out by the forward movement of the feeding plate following the upward movement of the upper mould. This feeding and discharging process is repeated in the manner described.

material is preparatorily dried for a full day and night and then subjected to a primary drying process in a drying machin f r about tw t three hours at a normal temperature. After having been dried, the raw rice mixture is loaded in the hopper 53'. An appropriate quantity of laver or sesame seeds, if desired, may be added to the unhulled rice after the rice has been primarily dried. The water content of the dried rice mixture is an important factor in the process. The water content is preferably in the range of from 10% to 20%, and more preferably in a range of from 14% to 18%. (The water content is about 15% to 16% before the washing and about 30% immediately after the washing.)

The raw rice mixture or unhulled rice loaded in the hopper 53' reaches to the dosimetric hole(s) 51 in the feeding plate 52 through the conduit 54. The lower and the upper moulds 34 and 43 are heated up to a temperature in a range of from 150°C to 240°C by the heaters 35 and 44 respectively before the apparatus is operated. More preferably, they are heated up to about 220°C. At this time, as shown in Figure 2, the feeding plate 52 is withdrawn rearwardly with the roller 59 abutted against the outer peripheral surface of the second cam plate 11. The lower mould 34 is moved upwardly to be flush with the peripheral mould 31, with the roller 40 on the protruded portion 19 of the first cam plate 20. On the other hand, the upper mould 43 is moved upwardly, with each roller 49 in the first recess 26 in the respective third cam plate 24. In the foregoing state, when the cam plates 20,22,24 are simultaneously rotated in the counter-clockwise direction owing to rotation of the shaft 16, the roller 59 starts falling into the recess 21 in the second cam plate 22 to cause the feeding plate 52 to move forwardly (leftward movement in Figure 2).

As soon as the roller 59 reaches the bottom portion of the recess 21 to cause the feeding plate 52 to be advanced to its foremost position with the hole(s) 51 brought to be in the central portion of the lower mould 34 (see Figure 5), the roller 40 starts falling from the protruding portion 19 of the first cam plate 20. As a result, the lower mould 34 is moved downwardly. Thus, the unhulled rice mixture R within the hole(s) 51 is fed to the intermediate portion of the lower mould 34. Likewise, when the roller 59 rides over onto the outer peripheral surface of the second cam plate 22 from the recess 21, the feeding plate 52 is caused to be completely withdrawn backwardly and waits for the next operation with the unhulled rice mixture for the next operation already fed into the hole(s) 51 (see Figure 6).

In accordance with the withdrawing motion of the feeding plat 52, ach roller 49 starts the riding-over m tion fr m the first recess 26 in the respective third cam plat 24. Accordingly, the upper mould 43 starts moving d wnwardly to ngage in the peripheral m uld 31, so that the upper and the lower m ulds 34 and 43 and th peripheral mould 31 together define a hermetically clos d chamber. Bef re long, th rollers 49 which have just completed the riding-over from the first recess 26 move slowly n th gentle gradient surface 24a and reach th uter peripheral surface f the third cam plates 24. In the meantime, th upper m uld 43 is gradually moved downward to compress the unhulled rice mixture R (see Figure 7) owing to the movement of the rollers 49 just described. During compression the rice mixture R is heated by the upper and lower moulds. The unhulled rice mixture R is compressed and heated for a few seconds.

During the foregoing process, each roller 49 which has moved on the outer peripheral surface of the respective third cam plate 24 falls into the second recess 27. Accordingly, the upper mould 43 is instantaneously finely moved up and down. This sudden reciprocation of the upper mould through a small distance scatters compressed gas (steam) within the chamber defined by the upper and lower moulds 34 and 43 and the peripheral mould 31. By this, the baked unhulled rice mixture R is dispersed and uniformly spread on the lower mould 34. In this state, the unhulled rice mixture R is kept subject to the compression and the baking.

At a time when the unhulled rice mixture R has been completely heated, each roller 49 starts falling into the respective first recess 26. This movement of the rollers 49 causes the upper mould 43 to resume its upward movement and remove the compression on the unhulled rice mixture R. At this moment, the unhulled rice mixture R instantaneously expands to form a rice cake or cracker Ra or a self-sustaining mixture within the chamber defined between the baking moulds 34 and 43 (see Figure 8). Thereafter, in accordance with the upward movement of the upper mould 43, the roller 40 rises over onto the protruded portion 19 formed on the first cam plate 20. Accordingly, the lower mould 34 is also moved upwardly. The lower and upper moulds 34 and 43 are now returned to the state as shown in Figure 3, and the feeding plate 52 starts moving forwardly again as described. The rice cake Ra on the lower mould 34 is pushed away by the forward movement of the feeding plate 52 and received in a container (not shown) through a chute 62.

Although a single dosimetric hole 51 is formed in the feeding plate 52 in the embodiment shown in Figure 2, a plurality of dosimetric holes 51 may be distributed as shown in Figure 4, so that the unhulled rice mixture R can be more evenly spread on the lower mould 34 when fed thereto. By this, a rice cake having a more uniformly thickness can be produced. Preferably, the holes are formed in a floral shape, as shown in Figure 4.

In the above embodiment, unhulled rice is used as a raw material. However, the raw material is not limited to unhulled rice. Alternatively, powder of other grains than unhulled rice, vegetables, fishes, r the like mixed with starch, fl ur, r th like may b processed into a granular f rm t be used as the material for producing a cake natural and s ft to the t eth and having a high nutritiv valu .

As described in th f r going, th moti n of the upper and the l wer baking m ulds and the feeding plate of the granular material is perated by mechanical means using cam plates and with ut using an air cylinder. Consequently the motion of

th component parts can b controlled accurately. The result is that cakes having a uniform thickness and therefore of a high product valu can be obtained. Furthermore, by adequately modifying the shape of the recess formed in the cam plate for actuating the upper baking mould, thickness of the resultant cake can be changed according to necessity. Since the apparatus can be made small in size and light in weight, it can be installed even in a limited space. Finally, the apparatus is appealing because of its simple construction, which is therefore hardly susceptible to trouble and inexpensive to manufacture.

CLAIMS

1. A method of producing a cake from granular raw or pre-processed material such as grain, unhulled rice, artificial rice, or chips of composite material, comprising:

compressing and heating the material for a predetermined time within a hermetically closed chamber defined between upper and lower heated baking moulds;

raising the upper mould briefly, without opening the chamber, thereby causing the material to spread on a bottom surface defined by the lower mould, and then compressing and heating the raw material again; and

expanding the compressed and heated material by moving the upper mould upwardly to remove the compression, the material being thereby formed into a self-sustaining structure.

2. A method as claimed in claim 1, wherein the heating is effected at a temperature in the range of from 150°C to 240°C.

3. A method as claimed in claim 1 or 2, wherein the material has a water content in the range of from 10% to 25%.

4. Apparatus for producing a cake from granular raw or pre-processed material such as grain, unhulled rice, artificial rice, or chips or composite material, comprising:

a heatable lower baking mould adapted to be moved upwardly;

a heatable upper baking mould adapted to be moved upwardly and downwardly relative to the lower mould and to be received within the lower mould in an air-tight manner at a time when the former is moved downwardly;

a slidable dosimeter for transporting a predetermined quantity of the said material contained in a hopper to the lower mould, the dosimeter being adapted to serve both for pushing outwardly a shaped and self-sustaining cake from said lower mould and for feeding a predetermined quantity of the said material into the lower mould when the upper mould is at a lifted position, the upper and lower moulds and the dosimeter being actuated by means of rotation f respective cam plates.

5. Apparatus for producing a cake from granular raw or pre-processed material such as grain, unhulled rice, artificial rice, or chips of composite material, comprising:

(a) a peripheral mould;

(b) a heatable lower baking mould movable up and down between a bottom position in which it closes the bottom of the peripheral mould in an air-tight manner and a top position in which its upper surface is substantially level with or above the top of the peripheral mould;

(c) a heatable upper baking mould movable up and down between an upper position in which it is spaced above the peripheral mould and a lower position in which it is received within the peripheral mould in an air-tight manner;

(d) a hopper for the granular material;

(e) a dosimeter slidable laterally between a first position in which it is below the hopper in order to receive the granular material and a second position above the peripheral mould in order to supply a predetermined quantity of the granular material onto the lower mould, the dosimeter being arranged to push a cake off the lower mould in its top position as the dosimeter moves from its first position to its second position; and

(f) rotary cams controlling the motion of the upper and lower moulds and the dosimeters so that they perform the following cycle of movements:

(i) with the upper mould in its upper position and the lower mould in its raised position, the dosimeter is moved from its first to its second position and back,

(ii) the lower mould is lowered to its bottom position and the upper mould is lowered to its lower position, thereby forming a hermetically closed chamber and compressing the granular material between the upper and lower moulds,

(iii) the upper mould is raised briefly, without opening the said chamber, and is then lowered to compress the material again,

(iv) the upper mould is raised to its upper position, and

(v) the lower mould is raised to its top position.

6. Apparatus as claimed in claim 4 or 5, wherein the dosimeter comprises a feeding plate having a plurality of holes.

7. A method of producing a cake from granular material, substantially as described with reference to the accompanying drawings.

8. Apparatus for producing a cake from granular material, substantially as described with reference to, and as shown in, the accompanying drawings.

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